

## **REMARKS**

Claims 1-3, 6-8, 10-21, 23-25, 34, 36, 37, 39-42, 44, 45, 47-49, 52-56, 59-62, 65-69, and 72-75 are pending in the application with claims 1, 13, 18, 34, 36, 37, 40, 44, 54, 61, 65, 68, and 75 amended and claims 4, 5, 22, 35, 38, 43, 46, 50, 51, 57, 58, 63, 64, 70, and 71 canceled herein. All of the amendments to claims made herein are supported by the subject matter of the previously pending claims.

Claims 1-8, 10-25, and 34-75 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuzumi (U.S. Patent No. 6,222,722) in view of Kim (U.S. Patent No. 6,207,487). Applicant requests reconsideration.

Amended claim 1 sets forth a capacitor fabrication method that includes, among other features, atomic layer depositing a conductive barrier layer to oxygen diffusion on and in physical contact with a first capacitor electrode and forming a capacitor dielectric layer on and in physical contact with the barrier layer. The barrier layer contains WN. Amended claim 1 thus includes, among other features, the subject matter of previous claims 4 and 5. Pages 3-4 of the Office Action allege that Fukuzumi discloses every limitation of claim 1 except for forming the conductive barrier layer using ALD and relies upon Kim as allegedly disclosing the missing subject matter. Applicant traverses.

Page 3 of the Office Action alleges that metal film 52 of Fukuzumi discloses the claimed conductive barrier layer. Page 4 of the Office Action alleges that Kim discloses forming a conductive barrier layer using ALD. Also, page 4 of the Office Action alleges that a motivation exists to substitute

metal film 52 of Fukuzumi with the ALD layer of Kim to suppress leakage current and inherently to inhibit oxygen diffusion into polysilicon film 51 of Fukuzumi. However, column 1, lines 8-10 and column 4, lines 8-11 reveal that Kim only describes formation of a dielectric film by ALD. At least for such reason, Applicant asserts that no suggestion or motivation exists in the prior art to form metal film 52 of Fukuzumi using the dielectric film ALD methods of Kim. Metal film 52 of Fukuzumi is required to be conductive, as stated in column 14, line 66 to column 15, line 2, and elsewhere throughout Fukuzumi. Hence, replacement of metal film 52 with the ALD dielectric film of Kim would frustrate the intended purpose and/or mode of operation of Fukuzumi.

Also, Fukuzumi describes a high-dielectric film 53 covering metal film 52. However, substitution of high-dielectric film 53 with the ALD dielectric film of Kim fails to disclose or suggest every limitation of claim 1.

Page 4 of the Office Action alleges that a conductive barrier layer formed over a capacitor electrode for suppression of leakage current inherently inhibits oxygen diffusion into the electrode. However, such a conclusion is erroneous. First, the leakage current inhibition described in Kim occurs by virtue of a dielectric layer thickness, not by virtue of a conductive barrier layer thickness. Kim discloses an  $\text{Al}_2\text{O}_3$  dielectric film thickness of about 70 Angstroms in column 5, lines 63-69. Even so, such description does not constitute disclosure of a conductive barrier layer thickness and density sufficient to address oxygen diffusion, such as discussed on page 12, lines 3-7 of the present specification. The Office

Action does not identify any support in the prior art for the allegation that inhibiting leakage current necessarily results in reducing oxygen diffusion.

Second, Kim fails to recognize any of the considerations set forth in the present specification that determine whether a conductive barrier layer addresses oxygen diffusion. The deficiency of Kim partly results from failure to recognize the problem resolved by the method of claim 1 and partly from failure to teach ALD of a barrier layer. Applicant notes that the problem confronted by the inventor must be considered in determining whether it would have been obvious to combine references in order to solve such problem. If the references do not address or even recognize the problem, then they cannot begin to teach or suggest a solution to it. Neither Fukuzumi nor Kim address the problem of oxygen diffusion solved by Applicant's invention and, accordingly, cannot suggest a solution to such problem.

The mere fact that certain thing may result from a given set of circumstances is not sufficient to establish inherency. Instead, some basis in fact and/or technical reasoning must exist to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art. No requirement exists that the ALD dielectric layer of Kim necessarily constitutes a barrier layer to oxygen diffusion. It follows that no basis in fact and/or technical reasoning necessarily flows from the teachings of Kim to inherently produce a conductive layer that addresses oxygen diffusion, as set forth in claim 1.

In keeping with the statements above, Applicant asserts that Kim fails to disclose or suggest ALD of a conductive barrier layer to oxygen diffusion,

contrary to the allegation in the Office Action. At least for such reason, Fukuzumi in view of Kim fails to disclose or suggest every limitation of amended claim 1. Claims 2, 3, 6-8, 10-12, 48, 49, and 52-54 depend from claim 1 and are patentable at least for such reason as well as for the additional limitations of such claims not disclosed or suggested.

For example, claim 10 sets forth ALD of another conductive barrier layer to oxygen diffusion over the dielectric layer. Fukuzumi and Kim do not disclose or suggest and the Office Action does not allege that they disclose or suggest the subject matter of claim 10. Review of both references does not reveal any teaching of another conductive barrier layer to oxygen diffusion.

Amended claim 13 sets forth a capacitor fabrication method that includes, among other features, chemisorbing a layer of a first precursor on and in physical contact with a first electrode and chemisorbing a layer of a second precursor on the first precursor layer. A chemisorption product of the first and second precursor layers being contained in a layer of a conductive barrier material containing WN. A capacitor dielectric layer is formed on and in physical contact with the barrier layer. As may be appreciated from the discussion above regarding the deficiencies of Fukuzumi in view of Kim as applied to claim 1, Applicant asserts that such combination fails to disclose or suggest the claimed chemisorption product of first and second precursor layers contained in a layer of conductive barrier material.

Claims 14-21, 23-25, 55, 56, and 59-61 depend from claim 13 and are patentable at least for such reason as well as for the additional limitations of such claims not disclosed or suggested. For example, claim 20 sets forth

that the barrier layer has a thickness and a density effective to reduce oxidation of the first electrode by oxygen from over the barrier layer.

Fukuzumi and Kim do not disclose or suggest and the Office Action does not allege that they disclose or suggest a thickness and density that reduces oxidation of the first electrode, as set forth in claim 20. Also, for example, claim 21 sets forth that the barrier layer has a thickness of from about 200 to about 500 Angstroms. As may be appreciated from the discussion above regarding patentability of claim 3, claim 21 is patentable.

Insert where appropriate. For example, claim 3 sets forth that the barrier layer has a thickness of from about 200 to about 500 Angstroms. Neither Fukuzumi nor Kim disclose or suggest a barrier layer having the thickness set forth in claim 3.

Amended claim 35 sets forth a capacitor fabrication method that includes, atomic layer depositing a first metal-containing conductive layer on and in physical contact with a first electrode containing HSG polysilicon. A capacitor dielectric layer containing oxygen is formed on and in physical contact with the first conductive layer. The method includes atomic layer depositing a second metal-containing conductive layer over the dielectric layer and forming a second capacitor electrode over the second conductive layer. As may be appreciated from the discussion above regarding the deficiencies of Fukuzumi in view of Kim as applied to claims 1 and 10, the cited combination fails to disclose or suggest every limitation of claim 34. Claims 36, 37, 39, 62, and 65-68 depend from claim 34 and are patentable at

least for such reason as well as for the additional limitations of such claims not disclosed or suggested.

Amended claim 40 sets forth a capacitor fabrication method that includes, among other features, chemisorbing a layer of a first precursor on and in physical contact with a first electrode containing HSG polysilicon and chemisorbing a layer of a second precursor on the first precursor layer. A chemisorption product of the first and second precursor layers is contained in a first layer of a metal-containing conductive material as a barrier to oxygen diffusion. A capacitor dielectric layer containing oxygen is formed on and in physical contact with the first conductive layer. The method includes chemisorbing a layer of the first precursor over the dielectric layer and chemisorbing a layer of the second precursor on the first precursor layer over the dielectric layer. A chemisorption product of the first and second precursor layers is contained in a second layer of a metal-containing conductive material as a barrier to oxygen diffusion. A second capacitor electrode is formed over the second conductive layer.

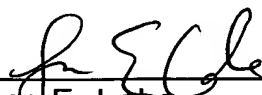
As may be appreciated from the discussion above regarding the deficiencies of Fukuzumi in view of Kim as applied to claims 1 and 10, such references fail to disclose or suggest every limitation of amended claim 40. Claims 41, 42, 44, 45, 47, 69, and 72-75 depend from claim 40 and are patentable at least for such reason as well as for the additional limitations of such claims not disclosed or suggested.

Applicant herein establishes adequate reasons supporting patentability of claims 1-3, 6-8, 10-21, 23-25, 34, 36, 37, 39-42, 44, 45, 47-49, 52-56, 59-

62, 65-69, and 72-75 and requests allowance of all such pending claims in the next Office Action.

Respectfully submitted,

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By:   
James E. Lake  
Reg. No. 44,854